



A new species of *Antigius* (Lepidoptera: Lycaenidae: Theclini) from Taiwan

YU-FENG HSU

Department of Life Science, National Taiwan Normal University, Taipei, Taiwan 116, R. O. C. E-mail: t43018@ntnu.edu.tw

Abstract

Antigius jinpingi, new species, is described from Taiwan, which Theclini fauna has been investigated extensively. The sister species of the new taxon is presumed to be *A. butleri*, a species distributed in the Asiatic continent and Japan. The larval host plant of *A. jinpingi* is unknown, but the most likely candidate is *Quercus dentata*, a deciduous oak with a relictual distribution in Taiwan.

Key words: hairstreak, butterflies, Formosa, Asia, *Antigius*, new species, Lycaenidae, Theclini

Introduction

Antigius Sibatani and Ito, 1942, is a small genus composed of four previously described species restricted to Asia. The male genitalia are characterized by a bifid uncus, a hook-like brachia, and a down-curved phallus; the female genitalia are distinguished by the lamella postvaginalis forming a broad sclerotized plate with a median groove (Shirôzu & Yamamoto 1956). Koiwaya (2007) pointed out that male genitalia of *Antigius* species are asymmetrical. The larvae of all known species have a caudal protrusion (Teshirogi 1997; Koiwaya 2007) and are ridged dorsally, giving them an unusual Y-shaped appearance in dorsal view (Koiwaya 2007: pl. 188, figs. 37–39). A similar larval pattern is seen only in *Saigusaozephyrus* Koiwaya, 1993 (Koiwaya 2007: pl. 189, Fig. 47) within Theclini, but the caudal end of *Saigusaozephyrus* is not produced.

Prior to 2002, two *Antigius* species were known (Kawazoé and Wakabayashi 1976; Fujioka 1993). *A. attilia* is widespread from Japan, Korea, Far East Russia, throughout northern, central, and western China, reaching Taiwan (Inomata 2003). In contrast, *A. butleri* was considered restricted to areas bordering the Sea of Japan (Fukuda *et al.* 1984) until Yoshino (1999) found it in Sichuan Province of southwestern China. *A. butleri* later was found to occur in Guangdong Province of southern China (Figs. 7–8; National Taiwan Normal University specimens). A third species, *A. shizuyai* Koiwaya, 2002, with reduced wing markings and extensive white scaling was described from Kachin state of northeastern Myanmar (Koiwaya 2002; Watanabe 2003). Additionally, a species of this genus with unusual marginal wing patterns was recognized from Zhejiang province of eastern China by Tong *et al.* (1993), but remained undescribed until 2004, when it was described as *A. cheni* Koiwaya, 2004, based on specimens from Sichuan province of western China (Koiwaya, 2004).

Taiwan's butterfly fauna is well known, and discovery of a fifth *Antigius* species (Figs. 1–4), described in this paper, was unexpected. As the Theclini comprise nearly one quarter of the lycaenid diversity of Taiwan (Hsu & Lu 2005), the tribe has been a popular group among those interested in Taiwan butterflies. Of the 26 species of Theclini currently known in Taiwan, 18 species (75%) were described by the end of World War II, and all but two species were known prior to 1970 (Shirôzu & Ueda 1992). Since then, only two Theclini species have been added to the fauna of Taiwan, namely *Sibatanozephyrus kuafui* Hsu and Lin, 1994, discovered in 1992 (Hsu & Lin 1994) and *Teratozephyrus nuwai elatus* Hsu & Lin, 2005, which was recognized by 2000 (Hsu & Lu 2005; Koiwaya 2007).

The newly discovered *Antigius* species (Fig. 1–4) is considered a distinct species, closely related to *A. butleri* (Figs. 5–8) and, is described herein. An identification key and a distribution map (Fig. 19) for known species of *Antigius* is also provided.

Materials and methods

The following specimens of *Antigius* were compared with the new taxon: *A. attilia* (1♂, Vladivostok, Far East Russia; 1♂, Hokkaido, Japan; 1♂,4♀, Honshu, Japan; 3♂,4♀, Taiwan; 1♂, Zhejiang Prov., China; 2♂,1♀, Jiangxi Prov., China; 1♀, Hunan Prov., China; 1♂,3♀, Gansu Prov., China), *A. butleri* (1♀, Vladivostok, Far East Russia; 1♀, Hokkaido, Japan; 2♂,1♀, Honshu, Japan; 1♂,1♀, Guangdong Prov., China), *A. cheni* (1♂,1♀, Sichuan Prov., China) and *A. shizuyai* (2♂,1♀, Kachin State, Myanmar[Burma]). Abdomens were placed in 10% KOH at room temperature for 24 h in order to dissolve the soft tissue, then transferred to cellusolve for another 24 h for descaling before finally being placed in 70% ethanol for genitalia dissection. Completed dissections are preserved in 70% ethanol. Structure of genitalia and body parts were examined using a Leica MZ6 microscope, and images of legs were captured using Helicon Focus 3.10 software. Terminology for wing patterns follows Nijhout (1991) and for genitalia Klots (1970). The holotype and one paratype of the new taxon are deposited in The Natural History Museum, London (BMNH), and the remaining two paratypes are in a private collection maintained by Jin-Ping Su (JPS).

Systematic accounts

Antigius jinpingi Hsu, new species

(Figs. 1–4, 9–13)

Type material. HOLOTYPE ♂(genitalia preparation YFH 1421): “TAIWAN: PINGDONG Co., Wutai, Wutoushan, 1200 m, N22° 43.855’ E120°46.604’, 8. v. 2005, J. P. Su” [white label, printed], “Holotype *Antigius jinpingi* Hsu ” [red label, printed]. The specimen is mounted on a regular pin and is in good condition.

PARATYPES (2♂, with same data as holotype); 1♂ (with same locality as holotype, 16. v. 2005, genitalia preparation YFH 1415).

Description. – Male (Figs. 1–2). Head: Frons hairy, brown, edged with white laterally and ventrally. Prominent hair tuft present on vertex. Chaetosemata forming a pair of transverse patches behind antennae, with both bristles and small acles. Eye semioval, sparsely hairy. Labial palpus porrect, white with distal tip brown. Length of antenna 6.6–7.1 mm (6.8 ± 0.2 mm, $n = 4$). Thorax: Brown dorsally, white ventrally. Legs white, banded by brown on tarsi; foretarsus with all tarsomeres completely fused, tubular, posttarsus vestigial (Fig. 3), mesotarsus and metatarsus with 5 tarsomeres, with posttarsus bearing a pair of claws (Fig. 4). Length of forewing 13.5–15.5 mm (14.6 ± 0.9 mm, $n = 4$). Forewing. Ground colour of upperside brown, with markings of underside barely visible. Fringe white mixed with brown. Ground color of underside white. Central symmetry system with distal band forming a brown band, displaced proximally in cell Cu1; proximal band represented by a small, dark brown dot. Element “g” barely visible, represented by an indistinct line from costa to M3. Marginal ocelli prominent, consisted of a series of dark brown spots parallel to termen, larger posteriad. Parafoveal elements forming a pale brown line. Discoidal spot present in the form of a brown bar. Hindwing ground colour of upperside brown, with markings of underside barely visible. Narrow white lines along termen. Fringe white but with outer cilia dark brown near tornus. “Taillike” projection of Cu2 slender, dark brown with white distal tip. Ground colour of underside white. Central symmetry system with distal band forming a brown band, broken at cell M2, displaced at Cu2, bent inwards in cell Cu2, proximal band forming three dark brown spots at proximal end of Sc + R1 cell, discoidal cell, and Cu1 cell. Discal spot present, form-

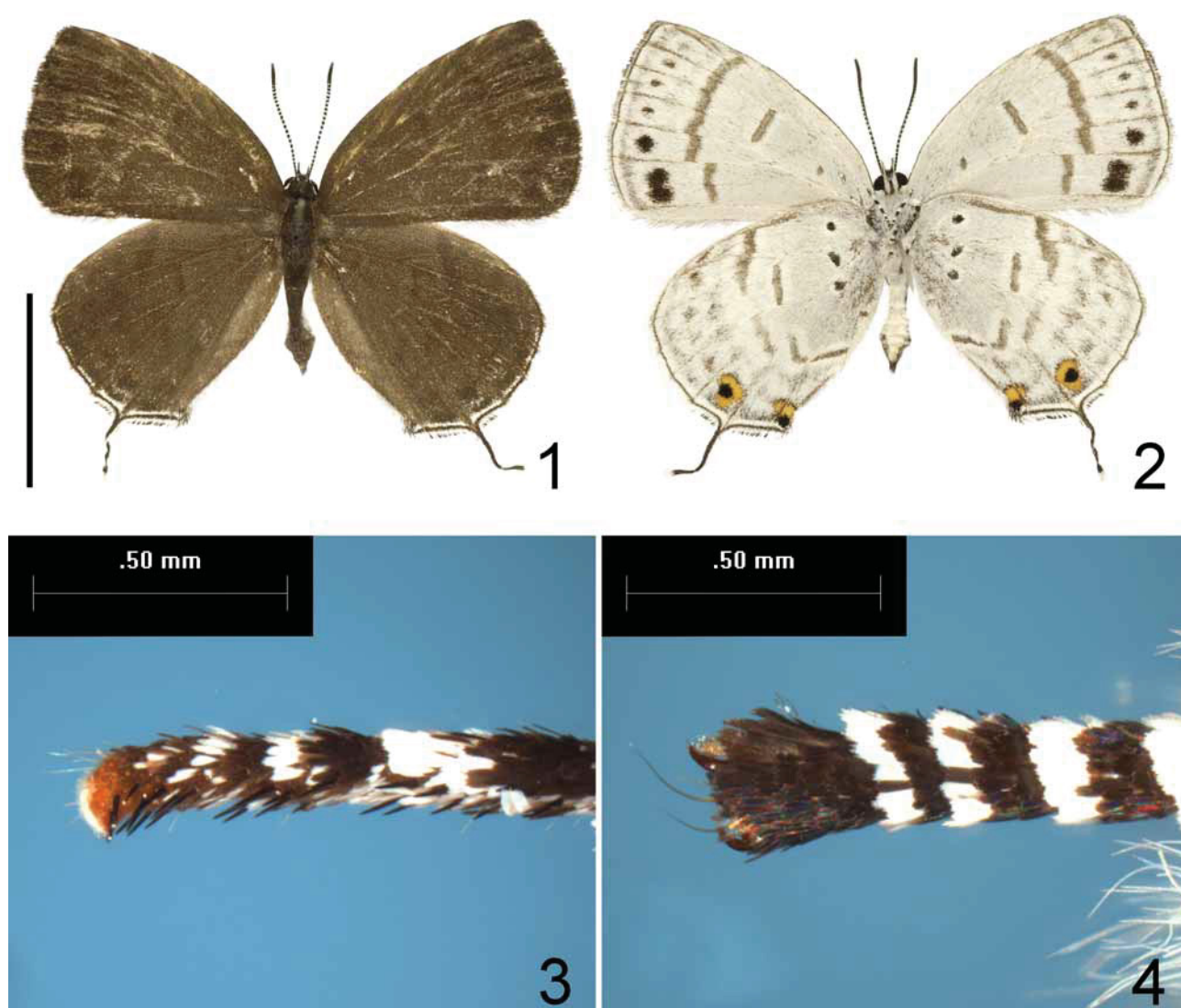
ing a brown bar. Element “g” represented by an obscure brown line parallel to termen. Marginal ocelli represented by a series of faint, brown dots, but forming a prominent dark brown spot encircled with orange in cell Cu1, and a dark brown spot crowned with orange at tornus. Parafoveal elements forming a pale brown line. Abdomen: Brown dorsally, white ventrally. Genitalia (Figs. 9–13) with sclerites of 9th and 10th segments fused, forming a complete ring, width approximately 0.64 x height. Tegumen somewhat asymmetrical, with right side longer than left side (Fig. 9); 9th +10th sclerites truncated posteriorly, bearing a paired, tapering, pointed uncus pointing ventrad; a pair of blunt protrusions present in front of brachia; brachium slender, hook-like, slightly swollen at base; saccus forming a semi-circular disc, 0.3 x tegumen height. Phallus elongate, 1.68 x tegumen height, with opening of aedeagus dorsad, positioned at right side. Cornuti present in the form of a sclerotized band bearing minute teeth. Valva simple, flaplike, curved upwards, with caudal margin rounded, slightly attenuated posteriorly. Juxta V-shaped.

Female: Unknown.

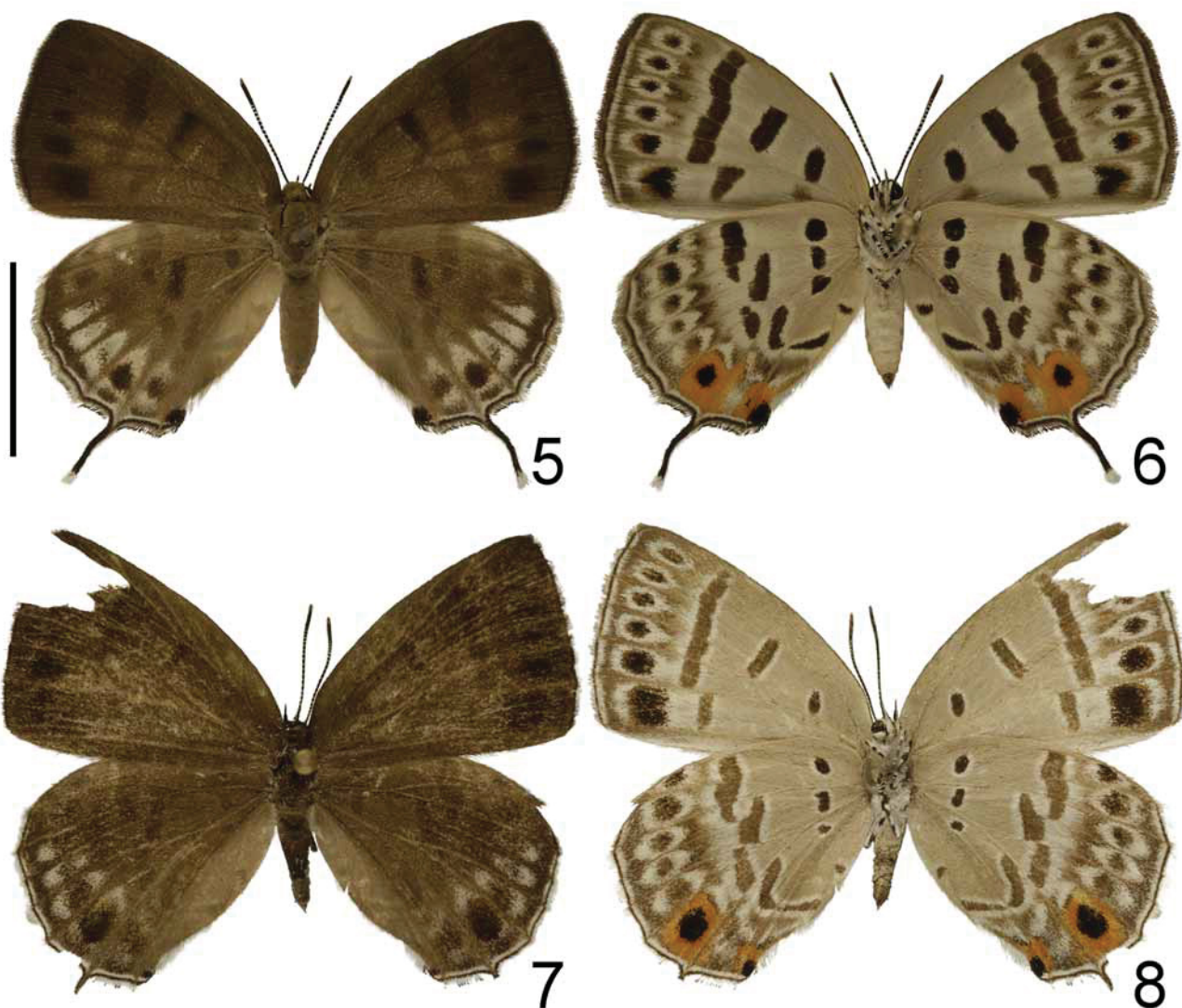
Distribution. This species is known only from Taiwan.

Hostplant. Unknown (but see discussion).

Voltinism. Evidently univoltine; adult occurs in May.



FIGURES 1–4. *Antigius jinpingi*. 1, holotype ♂, uppersides; 2, holotype ♂, underside; 3, foretarsus; 4, metatarsus. Scale bar of adult = 1 cm.

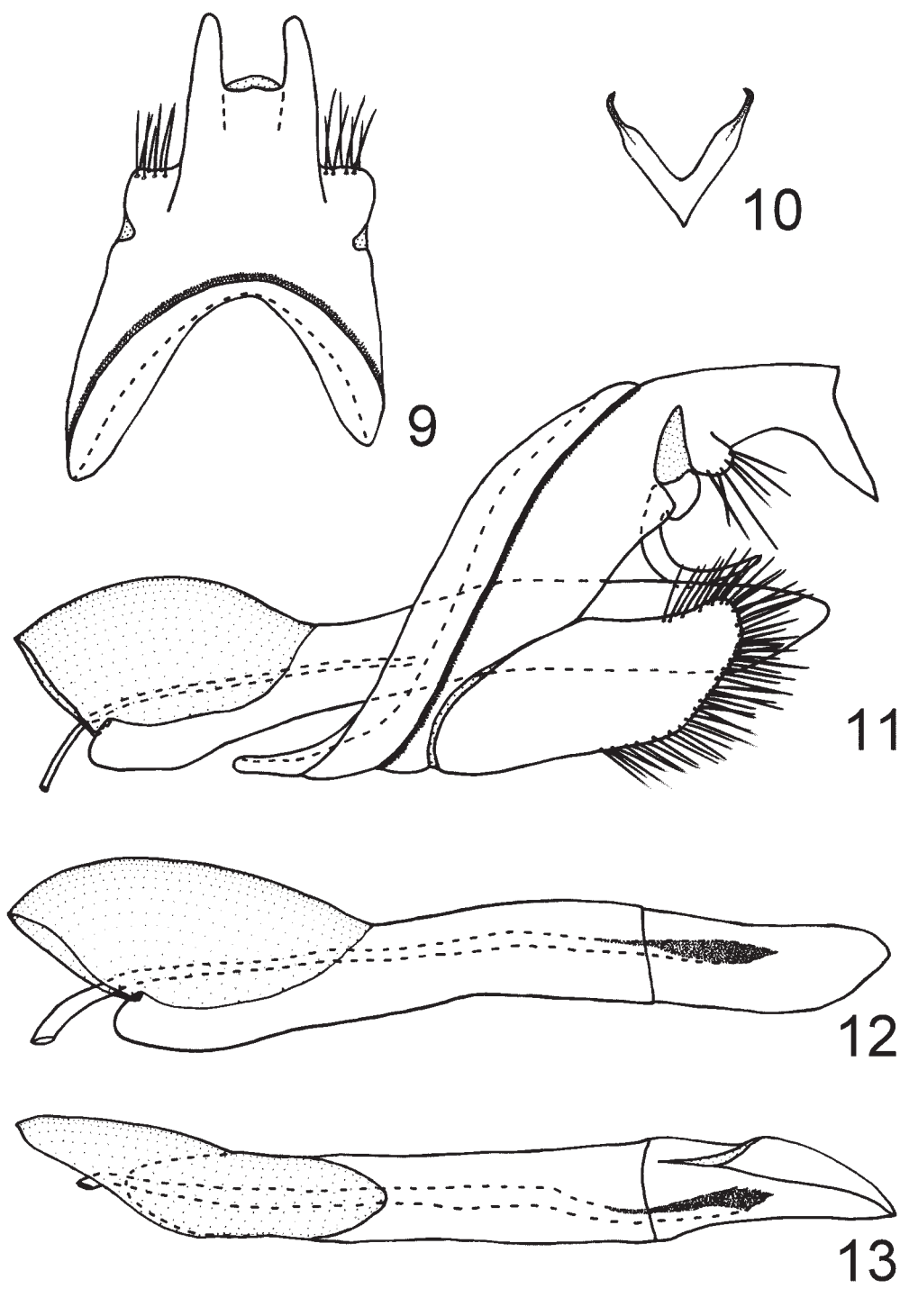


FIGURES 5–8. *Antigius butleri*. 5, ♂(Hokkaido, Japan), uppersides; 6, ♂ (Hokkaido, Japan), undersides; 7, ♂ (Guangdong, China), uppersides; 8, ♂ (Guangdong, China), undersides. Scale bar of adult = 1 cm.

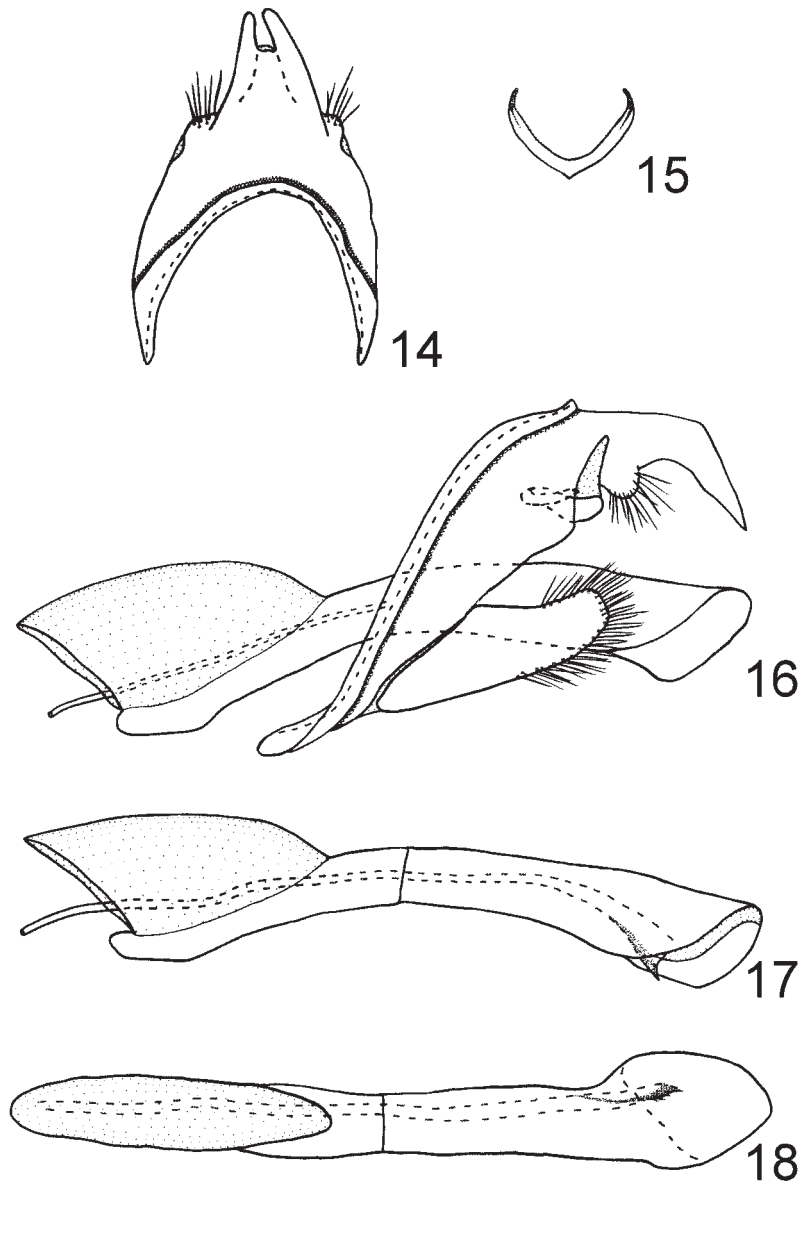
Etymology. The species is named after its discoverer, Mr. Jin-Ping Su, a prominent local beetle investigator.

Diagnosis: The wing pattern of *A. jinpingsi* most closely resembles that of *A. butleri* and *A. shizuyai*; they share a reduction of the distal band of the central symmetry system in the M-cells of the hindwing underside. This reduction is found in neither *A. attilia* nor *A. cheni* (Koiwaya 2007), thus representing a possible synapomorphy for these three taxa. Patterns on the forewing undersides of *A. butleri*, *A. shizuyai* and *A. jinpingsi* are similar, but the distal band of the central symmetry system is broken into a series of spots and displaced at M3 in *A. shizuyai* (Koiwaya 2002, 2007). By contrast, this band forms a continuous straight line in *A. butleri* (Figs. 6, 8) and *A. jinpingsi* (Fig. 2). Marginal ocelli and element “g” are prominent in *A. butleri* (Figs. 6, 8), but both are reduced in *A. jinpingsi* (Fig. 2). Prominent white markings are present on the hindwing upperside in both *A. butleri* (Figs. 5, 7) and *A. shizuyai*, but lacking in *A. jinpingsi* (Fig. 1). The male genitalia of *A. jinpingsi* (Fig. 9–13) is closest to that of *A. butleri* (Fig. 14–18); the valva in both species are rounded distally (Shirôzu and Yamamoto, 1956: pl. 52, fig. 15; p. 89, Kawazoé and Makibayashi 1976), but the valva of *A. jinpingsi* is broad and relatively short, with the width of broadest part 0.39x its length (Fig. 11). The valva of *A. butleri* is narrowed distally, relatively slender, with the width of broadest part 0.34 x its length (Fig. 16; Kawa-

zoé and Makibayashi 1976: p. 89). Socii are represented as a pair of prominent, setaceous protrusions near the base of the brachia in *A. jinpingi* (Fig. 9) but barely visible in *A. butleri* (Fig. 14; Shirôzu and Yamamoto, 1956: pl. 52, fig. 15; Kawazoé and Makibayashi 1976: p. 89). *A. cheni* possesses the most distinct male genitalia of known *Antigius* species, having a very short uncus, swollen brachia, and strongly asymmetrical valvae, with the right valva noticeably longer than the left (Koiwaya 2002). *A. attilia* and *A. shizuyai* both possess a slender, digitate uncus and valva, in contrast to a tapering uncus and broad valva found in *A. jinpingi* and *A. butleri*.



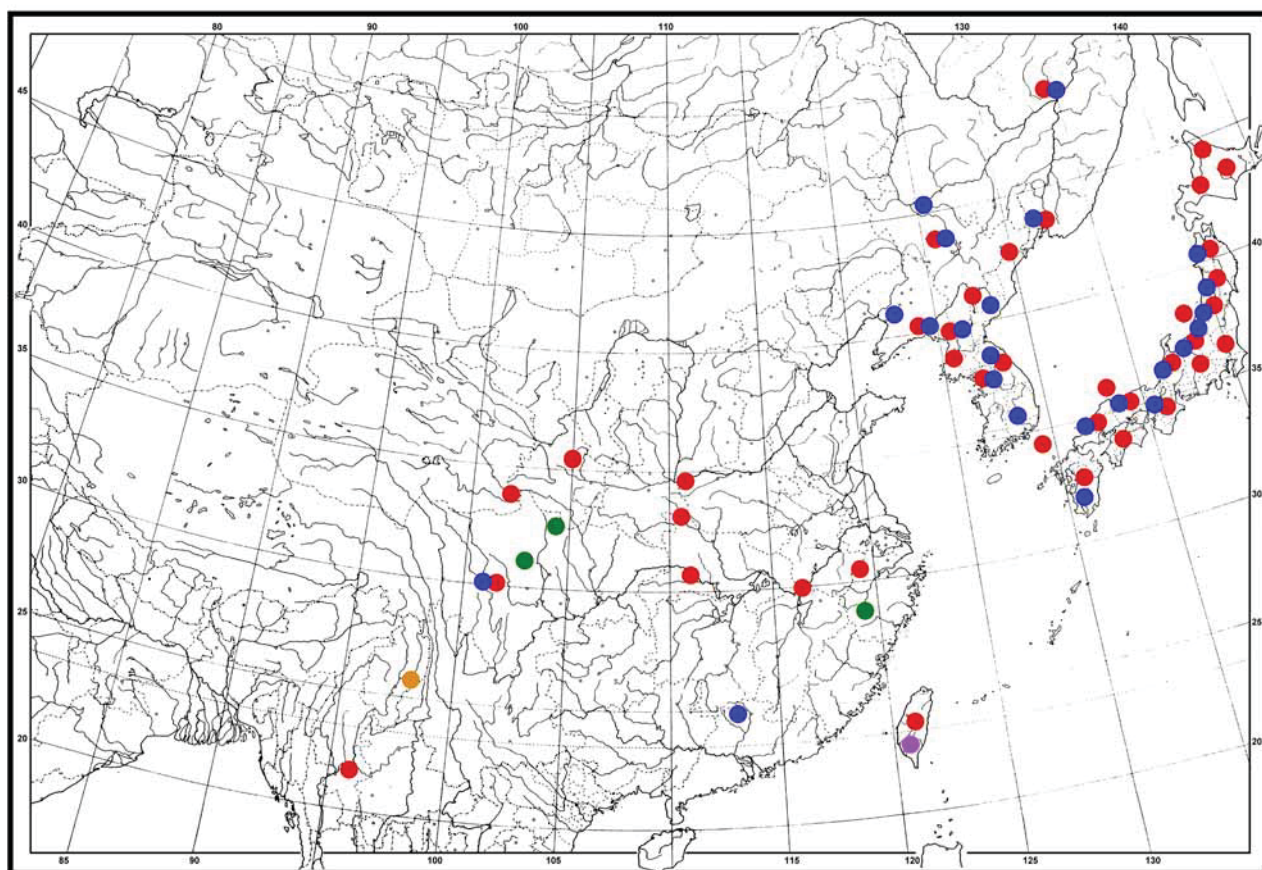
FIGURES 9–13. Male genitalia of *Antigius jinpingi*. 9, dorsal view of tegumen; 10, juxta; 11, lateral view of 9th + 10th sclerites, with right valva removed; 12, lateral view of phallus; 13, dorsal view of phallus. Scale bar = 1 mm.



FIGURES 14–18. Male genitalia of *Antigius butleri*. 14, dorsal view of tegumen; 15, juxta; 16, lateral view of 9th + 10th sclerites, with right valva removed; 17, lateral view of phallus; 18, dorsal view of phallus. Scale bar = 1 mm.

Key to the species of *Antigius*

1. Proximal band of central symmetry system absent on both wings 2
Proximal band of central symmetry system present on both wings 3
2. Distal band of central symmetry system of hindwing represented by a dark brown, V-shape band *A. attilia*
Distal band of central symmetry system of hindwing broken into an irregular line toward costa *A. cheni*
3. Distal band of central symmetry system of forewing represented by a dark band 4
Distal band of central symmetry system of forewing represented by a series of dark spots, forming a broken line
..... *A. shizuyai*
4. Marginal ocelli of hindwing underside prominent; white markings present on hindwing upperside *A. butleri*
Marginal ocelli of hindwing underside vestigial; no white markings on hindwing upperside *A. jinpingi*



FIGURES 19. Distribution map of *Antigius* species; red circle, *A. attilia*, blue circle, *A. butleri*, green circle, *A. cheni*, orange circle, *A. shizuyai*; purple circle, *A. jinpingi*. (data sources: Fujioka 1993; Koiwaya 2007; National Taiwan Normal University specimens)

Discussion

A. butleri, *A. shizuyai*, and *A. jinpingi* are the sole members in the Chaetoprocta lineage *sensu* Hsu and Chou (2001) that have the distal band of the central symmetry system in the M-cells of the hindwing underside reduced or absent, suggesting that this trait may represent a synapomorphy for these three species. *A. butleri* is considered a candidate for the sister taxon to *A. jinpingi* based on the rounded valva, in contrast to a truncated valva shared by *A. shizuyai*, *A. attilia*, and *A. cheni*. Within *Antigius*, the tapering uncus is also shared by *A. jinpingi* and *A. butleri*.

As *A. jinpingi* and *A. butleri* are allopatric in distribution (Fig. 19), it may be considered that the former is merely a subspecies of the latter. However, this is clearly not the case. *A. butleri* was thought to be endemic to the lands surrounding the Sea of Japan until two distant southern populations were discovered in Sichuan, western China and in Guangdong, southern China. Adult morphology of the recently discovered southern populations conforms to that of the northern populations (Figs. 5–8), despite the wide geographic discontinuity (Fig. 19). In contrast, *A. jinpingi* possesses wing patterns and male genitalia distinctive from those of *A. butleri*, warranting specific status. Thus *A. jinpingi* is regarded as a species endemic to Taiwan.

The host association of *A. jinpingi* is unknown, although all known *Antigius* species utilize *Quercus* spp. as primary larval hosts (Teshirogi 1997; Koiwaya 2007). Larval hosts of *A. attilia* include deciduous *Q. serrata* Thunb., *Q. acutissima* Carruth., *Q. mongolica* Fisch. ex Ledeb., and *Q. dentata* Thunb., whilst evergreen *Q. acuta* Thunb., *Q. salicina* Blume, and *Q. glauca* Thunb. are seldom used in Japan (Fukuda *et al.* 1984). In

Taiwan, *A. attilia* exclusively uses deciduous *Q. variabilis* Blume (Uchida 1999), and Koiwaya (2007) demonstrated that populations of this species in mainland China and Korea use similar host-plants. *A. butleri* is dependent on deciduous oaks as larval hosts in Japan and Korea (Fukuda *et al.* 1984; Koiwaya 2007). The deciduous *Q. griffithii* Hook & Thomson ex Miq. is the only known larval host for *A. shizuyai* in Myanmar [Burma], and the evergreen *Q. glaucoides* Martens & Galeotti is the only known larval host for *A. cheni* in western China (Koiwaya 2007). As all four of the known *Antigius* hairstreaks utilize only oaks as larval hosts, it seems likely that *A. jinpingi* also does. The vicinity of the type locality of *A. jinpingi*, the Wutai area of Pingdong County, supports the largest stands of deciduous *Q. dentata* in Taiwan, where this plant has a relictual distribution, with only two populations currently recognized (Chou 1997). As *Q. dentata* is frequently used as a larval host by *A. butleri*, the putative sister species of *A. jinpingi*, it is the most likely candidate as the larval host of the latter species. Alternatively, several evergreen oaks grow at the site, including *Q. glauca*, *Q. stenophylloides* Hayata, and *Q. tarokoensis* Hayata, may serve as larval hosts. *Q. tarokoensis* is a sclerophyllous oak, and there are only two other sclerophyllous oaks in Taiwan, namely *Q. spinosa* David and *Q. tatakaensis* Tomiya (Liao 1994; 1996). It should be noted that *Teratozephyrus nuwai elatus*, another Theclini species only recently discovered in Taiwan, was found to be associated exclusively with *Q. spinosa* and *Q. tatakaensis* (Hsu & Lu 2005). As *Q. tarokoensis* occurs commonly around the type locality of *A. jinpingi*, this is also considered a potential host-plant.

Acknowledgments

I thank Jin-Ping Su for allowing me to examine specimens he collected. I am also grateful to Tomoo Fujioka (Butterfly Society of Japan, Tokyo), Yasuyuki Watanabe (Lepidopterological Society of Japan, Tokyo), and Yoshiomi Kato (Department of Biology, International Christian University, Tokyo) for providing specimens for comparison. Comments from John Tennent (Department of Entomology, the Natural History Museum, London), Konrad Fiedler (Department of Population Ecology, University of Vienna) and anonymous reviewers greatly improved the manuscript and are heartily appreciated. Ming-Chiao Ke, Ting-Wei Chen, Chia-Hung Lin (Department of Life Science, National Taiwan Normal University), and Cheng-Chih Lu (Butterfly Conservation Society of Taiwan, Taipei) assisted in preparing the figures.

Literature cited

- Chou, F.J. (1997) *Study on the vegetation ecology of Quercus dentata in southern Taiwan*. M.S. thesis, Graduate Institute of Forestry, National Taiwan University, Taipei, 36 pp. (in Chinese with English abstract)
- Fujioka, T. (1993) Zephyrus (Theclini butterflies) in the world (3) – genus *Antigius* and allied genera –. *Butteflies*, 4, 3–20.
- Fukuda, H., Hama, E., Kuzuya, T., Takahashi, A., Takahashi, M., Tanaka, B., Tanaka, H., Wakabayashi, M. & Watanabe, W. (1984) *The life histories of butterflies in Japan*. Hoikusha Publishing Co., Ltd., Osaka, 373 pp. (in Japanese)
- Hsu, Y.F. & Chou, W.I. (2001) *Araragi panda* sp. n., an intermediate taxon in the phylogeny of Theclini (Lepidoptera: Lycaenidae: Theclinae). *Insect Systematics & Evolution*, 32, 155–168.
- Hsu, Y.F. & Lin, M.Y. (1994) Systematic position of *Sibatanozephyrus* and description of a new species from Taiwan (Lycaenidae: Theclinae). *Journal of Lepidopterists' Society*, 48, 128–147.
- Hsu, Y.F. & Lu, C.C. (2005) A new lycaenid butterfly exclusively associated with the subalpine sclerophyllous oak forests in Taiwan (Lepidoptera, Lycaenidae, Theclinae). *Journal of Natural History*, 39, 377–391.
- Inomata, T. (2003) The genus *Araragi* and its allies. *Gekkan-Mushi*, 389, 37–41. (in Japanese)
- Kawazoe, A. & Wakabayashi, M. (1976) *Coloured illustrations of the Japanese butterflies*. Hoikusha Publishing Co., Osaka, 422 pp. (in Japanese)
- Klots, A.B. (1970) Lepidoptera, pp. 115–130. In: Tuxen, S. L. (Ed), *Taxonomist's glossary of genitalia in insects*, 2nd edn. Munksgaard, Copenhagen.
- Koiwaya, S. (2002) Description of six new species and two new subspecies of the tribe Theclini (Lycaenidae) from

- Myanmar and Vietnam. *Gekkan-Mushi*, 381, 5–12. (in Japanese and English)
- Koiwaya, S. (2004) Description of a new species of the genus *Antigius* and discovery of male of *Howarthia kimurai*. *Gekkan-Mushi*, 405, 2–5. (in Japanese and English)
- Koiwaya, S. (2007) *The Zephyrus hairstreaks of the World*. Mushi-Sha, Tokyo, 300 pp. (in Japanese)
- Liao, J.C. (1994) *The taxonomic revisions of the family Fagaceae in Taiwan*. 2nd edn. National Taiwan University, College of Agriculture, Department of Forestry, Taipei, 241 pp. (in Chinese).
- Liao, J.C. (1996) Fagaceae, pp. 51–123. In: Huang T. C. (Ed.), *Flora of Taiwan*. 2nd edn. Volume 2. Editorial Committee of the Flora of Taiwan, Second Edition, Taipei.
- Nijhout, H.F. (1991) *The development and evolution of butterfly wing patterns*. Smithsonian Institution Press, Washington and London, xvi+297 pp.
- Shirôzu, T. & Ueda, K. (1992) Lycaenidae, pp. 136–139. In: Heppner J. B. & Inoue, H. (Ed.), *Lepidoptera of Taiwan*. Volume 1, Part 2: checklist. Association for Tropical Lepidoptera, Gainesville.
- Shirôzu, T. & Yamamoto, H. (1956) A generic revision and the phylogeny of the tribe Theclini (Lepidoptera: Lycaenidae). *Sieboldia*, 1, 329–421. (in Japanese with English abstract)
- Sibatani, A. & Ito, S. (1942) Beitrag zur Systematik der Theclinae im Kaiserreich Japan unter besonderer Berücksichtigung der sogenannten Gattung Zephyrus (Lepidoptera, Lycaenidae). *Tenthredo*, 3, 299–334.
- Teshirogi, M. (1997) *An illustrated book of Japanese Lycaenidae*. Tokai University Press, Tokyo. (in Japanese with English abstracts).
- Tong, X., Qian, Z. & Wang, L. (1993) *Butterfly fauna of Zhejiang*. Zhejiang Scientific Technology Press, Hangzhou. (in Chinese)
- Uchida, H. (1999) *The life histories of Taiwanese Theclini*. Published by author, Numazu, 207 p. (in Japanese).
- Yoshino, K. (1999) New butterflies from China 5. *Neo Lepidoptera* 4: 1–10.
- Watanabe, Y. (2003) Ecological notes on the tribe Theclini discovered from Kachin State, Myanmar. *Gekkan-Mushi*, 388, 2–9. (in Japanese)